

Appln No. 10/686,752
 Amdt. Dated 06/15/05
 Reply to Office Action of 04/01/05

In the Claims:

1. (Currently Amended) A method for determining optimum bond parameters ~~for including~~ a bond force F_b and an ultrasonic variable P_u ~~and, optionally, at least one further bond parameter G_b~~ , of a Wire Bonder for a bond process, whereby for this determination a number of bond cycles are carried out, whereby for each bond cycle a wire connection is made between a connection point of a semiconductor chip and a connection point of a substrate in that a wire end protruding out of a capillary is melted into a ball and then, in a bond position, the wire ball is attached to the connection point of the semiconductor chip, then the wire pulled through to the required length, formed into a wire loop and attached to the connection point of the substrate, and whereby the bond force F_b , the ultrasonic variable P_u and, if necessary, ~~the at least one further bond parameter G_b~~ parameters to be optimized are each varied in discrete steps within a predefined range, wherein with each bond cycle n , after attaching the wire ball to the connection point of the semiconductor chip, the following steps are carried out:

- a) ~~Application of~~ Applying a predetermined bond force F_{b1} ,
- b) ~~Movement of~~ Moving the capillary out of the bond position in a predetermined direction whereby the current $I_n(t)$ flowing through the drive which moves the capillary is monitored in the course of time t ,
- c) ~~Stopping the movement of the capillary as soon as the current $I_n(t)$ decreases,~~
- d) Determining the a maximum of the current $I_{n,max}(F_{b,n}, P_{u,n}, G_{b,n})$ from the progression of the current $I_n(t)$ established during steps b) and c) whereby the variables $F_{b,n}, P_{u,n}$ and $G_{b,n}$ are the values for bond force F_b , the ultrasonic variable P_u and, if necessary, the at least one further bond parameter G_b set for bond cycle n ,

and wherein from the values $I_{n,max}(F_{b,n}, P_{u,n}, G_{b,n})$ established with the n bonding processes those values for the bond force F_b , the ultrasonic variable P_u and, if necessary, ~~at least one further bond parameter G_b~~ parameters are determined as

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optimum bond parameters for which the current $I_{n,max}(F_{w,n}, P_{w,n}, G_{w,n})$ reaches a maximum.

2. (Currently Amended) A method for determining the optimum bond parameters ~~for including~~ a bond force F_w and an ultrasonic variable P_w ~~and, optionally, at least one further bond parameter G_w of a Wire Bonder for a bonding process, whereby for this determination a number of bond cycles are carried out, whereby for each bond cycle a wire connection is made between a connection point of a semiconductor chip and a connection point of a substrate, in that a wire end protruding out of a capillary is melted into a ball and then, in a bond position, the wire ball is attached to the connection point of the semiconductor chip, then the wire pulled through to the required length, formed into a wire loop and attached to the connection point of the substrate, and whereby the bond force F_w , the ultrasonic variable P_w and, if necessary, the at least one further bond parameter G_w parameters to be optimized are each varied in discrete steps within a predefined range, wherein with each bond cycle n after attaching the wire to the connection point of the substrate the following steps are carried out:~~

- a) ~~Application of~~ Applying a predetermined bond force $F_{w,n}$,
- b) ~~Movement of~~ Moving the capillary out of the bond position in a predetermined direction whereby the current $I_n(t)$ flowing through the drive which moves the capillary is monitored in the course of time t ,
- c) ~~Stopping the movement of the capillary as soon as the current $I_n(t)$ decreases,~~
- e)-d) Determining the a maximum of the current $I_{n,max}(F_{w,n}, P_{w,n}, G_{w,n})$ from the progression of the current $I_n(t)$ established during steps b) and c) ~~whereby the variables $F_{w,n}$, $P_{w,n}$ and $G_{w,n}$ are the values for bond force F_w , the ultrasonic variable P_w and, if necessary, the at least one further bond parameter G_w set for bond cycle n ,~~

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and wherein from the values $I_{n,max}(F_{w,n}, P_{w,n}, G_{w,n})$ established with the n bonding processes those values for the bond force F_w , the ultrasonic variable P_w and the, if necessary, at least one further bond parameter G_w parameters are determined as optimum bond parameters for which the current $I_{n,max}(F_{w,n}, P_{w,n}, G_{w,n})$ reaches a maximum.

3. (Currently Amended) A method for in situ monitoring of the quality of bond connections which are produced by means of a wire-feeding capillary of a Wire Bonder with predetermined values F_1, P_1, G_1 of a bond force F , an ultrasonic variable P and at least one further bond parameter G , wherein a to be tested, selected bond connection is made as follows:

Making a bond connection with predefined values F_2, P_2, G_2 for the bond force F , the ultrasonic variable P and the at least one further bond parameter G , whereby at least one of the values F_2, P_2, G_2 is less than the corresponding value F_1, P_1, G_1 .

Carrying out a test according to the following steps:

- a) ~~Application of~~ Applying a predetermined bond force F_2 ,
- b) ~~Movement of~~ Moving the capillary out of the bond position in a predetermined direction whereby the a current $I_n(t) \rightarrow I(t)$ flowing through the drive which moves the capillary is monitored over the course of time t ,
- c) Stopping the movement of the capillary as soon as the current $I(t)$ decreases,
- d) Determining the a maximum current $I_{max}(F_2, P_2, G_2)$ from the progression of the current $I(t)$ established during steps b) and c);

and

Making the bond connection with the values F_1, P_1, G_1 .

4. (Original) The method of claim 3, wherein the value P_2 is less than the value P_1 .